Ultra Long Duration Balloon Project

ULDB Verification Plan (UVP)

November 2, 1998

820-ULDB-UVP-001.0

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ULDB Verification Plan

CHANGE CONTROL

Revision	Modifications	Date Released	Modified by
1.0	First Official Release	11/2/98	David Stuchlik

F&PR#	Description	Verification Method	Auditor Verification
2.1.1.a	Float altitude of 35,000 m	Analysis	
		Demonstration	
		Test Flights	
2.1.1.b	Altitude requirement	Analysis	
		Demonstration	
		Test Flights	
2.1.2.a	Support science weight of 1,000 kg	Analysis	
		Demonstration	
		Test Flights	
2.1.2.b	Support balloncraft, etc. weight of 600 kg.	Analysis	
		Demonstration	
		Test Flights	
2.1.3.a	Payload attachment	Analysis	
		Demonstration	
		Test Flights	
2.1.4.a	Allowable Gross Inflation of 5,000 kg	Test Flights	
2.1.4.b	Launch with surface winds of up to 10 knots	Test Flights	
2.1.4.c	Launch method and inflation rate	Analysis	
		Demonstration	
		Test Flights	
2.1.5.a	Two termination methods	Analysis	
		Demonstration	
		Test Flights	
2.1.6.a	Radar visibility	Demonstration	
2.1.7.a	Boxing, Shipment, and Storage	Demonstration	
2.2.1.a	Vent Valve	Inspection	
2.2.1.b	Flow Rate 1	Flow Tests	
		Test Flights	
2.2.1.c	Flow Rate 2	Flow Tests	
		Test Flights	
2.2.1.d	Open/Close Time	Timing Tests	
		Flight Tests	
2.2.1.e	Auto Control	Demonstration	

		Simulation Tests	
		Flight Tests	
2.2.1.f	Support Phase II-V Flights	Analysis	
		Demonstration	
2.2.1.g	Manual Control	Demonstration	
2.2.1.h	Flight Environment	Environmental Tests	
		Flight Tests	
2.2.2.a	Provide a repository for ballast materials	Calculation	
		Demonstration	
		Test Flight(s)	
2.2.2.b	Provide a method for releasing ballast at a controlled rate upon command	Thermal Analysis	
		Thermal Vaccuum Functional Test	
		Test Flight(s)	
2.2.2.c	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Material UV exposure analysis	
		Material UV exposure test	
		Test Flight(s)	
2.3.1.a	Provide safe, controlled payload descent from termination altitude to ground impact	Descent Analysis	
		Inspection	
		Subscale sleeve tests	
		Test Flight(s)	
2.3.1.b	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Material Exposure Analysis	
		Pull Test	
		Test Flight(s)	
2.3.2.a	Minimize land impact damage	Strength analysis	
		Drop test(s)	
		Test Flight(s)	
2.3.2.b	Maintain functionality and structural integrity in ULDB environment for mission duration	Material Exposure Analysis	
		Test Flight(s)	
2.4.1.a	Provide separation of payload from balloon upon command	Functional test	
		Test Flight(s)	

2.4.1.b	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Structural analysis	
		Thermal Analysis	
		Thermal/Load test	
		Test Flight(s)	
2.4.2.a	Provide separation of parachute from Balloonecraft after land impact	Functional test	
		Test Flight(s)	
2.4.2.b	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Structural analysis	
		Thermal Analysis	
		Thermal/Load test	
		Test Flight(s)	
2.4.3.a	Provide structural system between the balloon and the payload that also exhibits torsional resistance	Inspection	
		Test Flight(s)	
2.4.3.b	Maintain functionality and structural integrity in ULDB environment for mission duration	Structural analysis	
		Thermal Analysis	
		Load Test	
		Test Flight(s)	
2.4.4.a	Provide flight train interface between cable ladder and azimuth pointing system	Inspection	
		Test Flight(s)	
2.4.4.b	Provide interface between balloon vehicle and launch vehicle	Inspection	
		Test Flight(s)	
2.4.4.c	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Structural analysis	
		Load Test	
		Test Flight(s)	
2.4.5.a	During ascent, provide visual indicator of balloon location to aircraft below 35,000 feet AMSL	Functional test	
		Test Flight(s)	
2.4.5.b	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Thermal/Functional test	
		Test Flight(s)	
3.1.1.a	Provide efficiency of 5 percent at 0-50 C	Test	

3.1.1.b	Provide 54 watts per kg	Test	
3.1.1.c	Provide 1200 watts of power	Functional test	
3.1.1.d	Provide 60 watts per sq. meter	Test	
3.1.1.e	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.1.2.a	Provide 10 amp charging capability	Test	
3.1.2.b	Provide charging over solar panel input voltage range	Test	
3.1.2.c	Provide battery temperature compensation	Test	
3.1.2.d	Maintain functionality in ULDB environment for mission duration	Test Flight(s)	
3.1.3.a	Provide 42.5 AH per pack	Test	
3.1.3.b	Operate at flight altitude	Vaccuum Test	
3.1.3.c	Operate at temperature range of 0 to 40 C	Temperature Test	
3.1.4.a	Provide mounting platform for 212 sq-ft of photovoltaic cells	Strength Analysis	
		Thermal Analysis	
		Vendor QA	
		Inspection	
		Load Testing	
		Subscale Thermal Testing	
		Test Flight(s)	
3.1.4.b	Integrate with payload in stowed position acceptable under launch vehicle restrictions	Inspection	
		Demonstration	
		Test Flight(s)	
3.1.4.c	Deploy upon command at float altitude to an fixed tilt angle of 37 degrees from vertical	Strength Analysis	
		Inspection	
		Thermal Analysis	
		Deployment Test	
		Subscale Thermal Vac. Deployment Test	
		Test Flight(s)	
3.1.4.d	Provide back-up array platforms for powering critical systems	Strength Analysis	
		Thermal Analysis	
		Vendor QA	
		Inspection	
		Load Testing	

		Subscale Thermal Testing	
		Test Flight(s)	
3.1.4.e	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Covered by above	
3.1.5.a	Provide automatic failover to backup power	Test	
3.1.5.b	Provide a minimum of seven day capacity	Analysis	
		Test	
3.1.5.c	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.2.1.a	Provide redundant terminate pyrotechnics and circuitry	Inspection	
3.2.1.b	Provide redundant line of sight command reception	Inspection	
3.2.1.c	Provide redundant command decoding and execution	Inspection	
3.2.1.d	Provide data monitoring and transmission subsystem	Inspection	
3.2.1.e	Provide ability to command via Balllooncraft communications subsystems	Test	
3.2.1.f	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.2.2.a	Provide independent power switching for all balllooncraft and instrument subsystems	Test	
3.2.2.b	Provide short circuit protection for all balllooncraft and instrument subsystems	Test	
3.2.2.c	Provide monitor points for all power switches	Inspection	
3.2.2.d	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.2.3.a	Provide power bus wiring	Inspection	
3.2.3b	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.1.1.a	Provide noise figure of less than 2.5 dB	Test	
3.3.1.1.b	Support command rate of 125 bps	Test	
3.3.1.1.c	Provide maximum BER of 1 x 10-5 at power input of -140 dBm at 125 bps	Test	
3.3.1.1.d	Provide compatibility with TDRSS satellite forward link	Test	
3.3.1.1.e	Provide 5 watts RF output power +1.0, -0.5 dB	Test	
3.3.1.1.f	Provide a frequency stability of 1.0 ppm over the temperature range of -10 C to +55 C	Test	

3.3.1.1.g	Provide spurious and harmonic outputs of less than -60 dB relative to carrier	Test	
3.3.1.1.h	Provide compatibility with TDRSS satellite return link	Test	
3.3.1.1.i	Support return link data rates from 1kbps to 150 kbps	Test	
3.3.1.1.j	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.1.2.a	Provide maximum VSWR of 1.5:1	Test	
3.3.1.2.b	Provide omni-directional gain pattern in azimuth	Test	
3.3.1.2.c	Provide 0 dB gain +5, -1 dB at elevation angles from -6 to +80 degrees	Test	
3.3.1.2.d	Provide greater than -5 dB gain at elevation angles from 80 to 90 degrees	Test	
3.3.1.2.e	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.1.3.a	The system shall transmit and receive ULDB data	Interface test	
3.3.1.3.b	The system shall transmit a maximum of 150 kbps with a minimum of 3 dB link margin	Calculation	
		Test	
3.3.1.3.c	The system shall point to the optimum satellite using GPS positional data	Test	
3.3.1.3.d	Provide a slew rate of 9 degrees per second	Test	
3.3.1.3.e	Provide a pointing accuracy of +/- 5 degrees	Test	
3.3.1.3.f	Provide pointing over 360 degrees azimuth without cable wrap	Test	
3.3.1.3.g	Provide pointing from -6 to +90 degrees elevation without cable wrap	Test	
3.3.1.3.h	Maintain functionality and structural integrity in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.1.4.a	Provide break before make connection	Test	
3.3.1.4.b	Provide a maximum VSWR of 1.5:1	Test	
3.3.1.4.c	Provide an isolation of 60 dB minimum	Test	
3.3.1.4.d	Provide an insertion loss of 0.5 dB maximum	Test	
3.3.1.4.e	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.1.5.a	Provide manufacturer's specified frequency band rejection characteristics	Test	

3.3.1.5.b	Provide manufacturer's specified insertion loss characteristics	Test	
3.3.1.5.c	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.1.6.a	The board shall provide two serial data streams compatible with the I and Q inputs on the TDRSS transponder	Test	
3.3.1.6.b	The serial data streams shall conform to the TDRSS users guide requirements	Test	
3.3.1.6.c	The board shall support multiple bit rates	Test	
3.3.1.6.d	The board shall support Òcombined I and QÓ mode	Test	
3.3.1.6.e	The board shall interface to the PC104 bus for data transfer from the flight processors	Test	
3.3.1.6.f	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.2.1.a	The subsystem shall transmit data and receive commands via the INMARSAT network	Demonstration	
3.3.2.1.b	The subsystem shall meet or excced all INMARSAT specifications for the Inmarsat-C Network	Inspection	
3.3.2.1.c	Input power 80 w during transmit, 9.5 w during receive	Test	
3.3.2.1.d	Terminal operating temperature range -25 C to 55 C	Test	
3.3.2.1.e	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.2.2.a	Antenna operating temperature range -35 C to 55 C	Test	
3.3.2.2.b	EIRP 14 dBW +/- 2 dB at 5 degrees elevation	Analysis	
3.3.2.2.c	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.3.1.a	The unit shall transmit serial data	Interface test	
3.3.3.1.b	The unit shall be certified to be compatible with the ARGOS satellite system	Inspection	
3.3.3.1.c	Unit shall not exceed peak power output of 2.0W/ 550mA at 14.0 VDC or 0.7W/400mA at 7.0 VDC during transmission into a 50 Ohm load	Test	
3.3.3.1.d	A Òtransmit error countÓ mode shall occupy 4 bytes and be host controlled	Test	
3.3.3.1.e	A ÒFailsafeÓ mode shall be host controlled	Test	
3.3.3.1.f	Operating Temperature Range = -40C to +70C	Environmental test	
		Test Flight(s)	

3.3.3.2.a	Antenna shall be a 1/2 wave base loaded UHF Omni Whip	Inspection	
3.3.3.2.b	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.4.1.a	2 Watt Minimum RF Power	Demonstration	
3.3.4.1.a	1 Mhz Band Width	Demonstration	
3.3.4.1.a	Operate To Edge of LOS TM Range	Test Flight	
3.3.4.1.b	Powered by 28 +/- 4 VDC	Demonstration	
3.3.4.1.b	700 mA Maximum power draw	Demonstration	
3.3.4.1.c	Transmit Rate 0-350 kbps biphase	Demonstration	
3.3.4.1.d	Operates at -20C to +70C	Thermal / VAC Testing	
		Test Flight	
3.3.4.1.d	Operates at unlimited altitude	Thermal / Vac Testing	
		Test Flight	
3.3.4.2.a	360 deg. Azimuth / Hemispherical	Demonstration	
		Test Flight	
3.3.4.2.a	Operate to Edge of LOS TM Range	Test Flight	
3.3.4.2.b	Vertical Polarization	Demonstration	
3.3.4.2.c	Operate at ambient balloon environment	Thermal / VAC Testing	
		Test Flight	
3.3.5.1.a	Command data rate of 300 bps	Demonstration	
3.3.5.1.b	Sensitivity (20 db quieting) 0.5 microvolt	Demonstration	
3.3.5.1.b	Operate to Edge of LOS TM Range	Test Flight	
3.3.5.1.c	Powered by 8.5 - 16 VDC	Demonstration	
3.3.5.1.c	<100 ma unsquelched	Demonstration	
3.3.5.1.d	Operates at -30C to +60C	Thermal / VAC Testing	
		Test Flight	
3.3.5.1.d	Operates at Unlimited Altitude	Thermal / VAC Testing	
		Test Flight	
3.3.5.2.a	360 deg. Azimuth / Hemispherical	Demonstration	
		Test Flight	
3.3.5.2.a	3 db gain	Demonstration	
3.3.5.2.a	Operate to Edge of LOS TM Range	Test Flight	
3.3.5.2.b	Vertical Polarization	Demonstration	
3.3.5.2.c	Operate at ambient balloon environment	Thermal / VAC Testing	
		Test Flight	
3.3.6.1.a	Provide data transmission and reception through satellite network	Test	

3.3.6.1.b	Interface to flight processors for commands and data	Test	
3.3.6.1.c	Meet manufacturer's specifications	Test	
3.3.6.1.d	Maintain functionality in ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.6.2.a	Meet manufacturer's specifications	Test	
3.3.6.2.b	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.7.1.a	Transmit GPS Position via the ARGOS network	Demonstration	
3.3.7.1.b	Meet manufacturer's specs for peak power, current, and loading during transmissions	Test	
3.3.7.1.c	Operating Temperature range shall be -40C to +60C	Environmental test	
3.3.7.1.d	GPS position accuracy shall be 25m, velocity accuracy shall be 0.1 m/sec, and time accuracy = 1 micro-second	Test	
3.3.7.1.e	GPS shall operate at 130,000 ft.	Test	
3.3.7.1.f	Unit shall output power at +30dbm, ± 1db with ALC	Test	
3.3.7.1.g	GPS acquisition from a cold start shall be 2 to 5 minutes, warm start shall be 50 seconds.	Test	
3.3.7.2.a	Antenna shall be a 1/2 wave base loaded UHF Omni Whip	Inspection	
3.3.7.2.b	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.3.7.3.a	The antenna shall receive RF signal data from GPS satellites	Test	
3.3.7.3.b	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.1.a	Provide MIL-STD 1553B wiring for science computer data and commands	Test	
3.4.1.1.b	Support science data bit rates up to 9 kbps	Test	
3.4.1.1.c	Provide MIL-STD 1553B wiring for TDRSS transponder data and commands	Test	
3.4.1.1.d	Provide conformance to MIL-STD 1553B	Inspection	
3.4.1.1.e	Provide redundant bus architecture	Inspection	
3.4.1.1.f	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	

		Test Flight(s)	
3.4.1.2.a	Provide analog data wiring from Balloncraft sensors to acquisition electronics	Test	
3.4.1.2.b	Provide digital data wiring from Balloncraft sensors to acquisition electronics	Test	
3.4.1.2.c	Provide digital data wiring from UTP to Balloncraft	Test	
3.4.1.2.d	Provide AART digital data wiring from Balloncraft subsystems to flight processors	Test	
3.4.1.2.e	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.3.a	Provide digital data wiring from CAP to UTP	Test	
3.4.1.3.b	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.4.1.a	Provide multiple channels of analog data acquisition (A/D conversion)	Test	
3.4.1.4.1.b	Provide multiple channels of discrete digital data acquisition	Test	
3.4.1.4.1.c	Provide interface to flight processors to transfer acquired data	Test	
3.4.1.4.1.d	Provide discrete outputs for execution of commands	Test	
3.4.1.4.1.e	Provide timed command output	Test	
3.4.1.4.1.f	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.4.2.a	Provide multiple channels of analog data acquisition (A/D conversion)	Test	
3.4.1.4.2.b	Provide multiple channels of discrete digital data acquisition	Test	
3.4.1.4.2.c	Provide interface to flight processors to transfer acquired data	Test	
3.4.1.4.2.d	Provide discrete outputs for execution of commands	Test	
3.4.1.4.2.e	Provide timed command output	Test	
3.4.1.4.2.f	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.4.3.a	Receive commands from uplink command receiver	Test	
3.4.1.4.3.b	Decode and error check received commands	Test	
3.4.1.4.3.c	Execute commands via discrete outputs	Test	
3.4.1.4.4.d	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	

3.4.1.5.a	Provide multiple channels of analog data acquisition (A/D conversion)	Test	
3.4.1.5.b	Provide multiple channels of discrete digital data acquisition	Test	
3.4.1.5.c	Provide multiple channels of RS-232 data acquisition	Test	
3.4.1.5.d	Provide encoded data to FM transmitter to transfer acquired data	Test	
3.4.1.5.e	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.6.a	Route command data from uplink command receivers to required destinations	Test	
3.4.1.6.b	Route Balloncraft data to required destinations	Test	
3.4.1.6.c	Buffer data to multiple simultaneous destinations	Test	
3.4.1.6.d	Buffer command data to multiple simultaneous destinations	Test	
3.4.1.6.e	All route switching to be controllable via flight computers' discrete command outputs	Test	
3.4.1.6.f	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.7.a	Provide non-buffered distribution of BC analog signals to required destinations	Test	
3.4.1.7.b	Provide non-buffered distribution of BC digital signals to required destinations	Test	
3.4.1.7.c	Provide signal test points	Test	
3.4.1.7.d	Provide modifiable distribution connections	Test	
3.4.1.7.e	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.1.8.a	Provide RF connections between receivers and antennas	Test	
3.4.1.8.b	Provide RF connections between transmitters and antennas	Test	
3.4.1.8.c	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.2.a	Provide non-volatile on-board storage of all data and commands received by the flight processors	Analysis	
3.4.2.b	Provide the required amount of storage	Test	
3.4.2.c	Provide a separate, independant data storage subsystem for each flight processor	Inspection	
3.4.2.d	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.3.1.a	Processor to be 486 class or above	Inspection	

3.4.3.1.b	Industrial grade or better	Inspection	
3.4.3.1.c	upgradeable processor	Inspection	
3.4.3.1.d	PC104 form factor	Inspection	
3.4.3.1.e	Flash BIOS required or custom BIOS	Inspection	
3.4.3.1.f	Capable of supporting RTOS	Inspection	
3.4.3.1.g	Sufficient processing power to support ULDB flight code	Analysis	
		Test	
3.4.3.1.h	Input power shall be 6.0 watts maximum	Test	
3.4.3.1.i	Maintain functionality in ULDB environment for mission duration	Environmental test	
3.4.3.2.a	PC/104 form factor	Inspection	
3.4.3.2.b	COTS available and operate in embedded industrial applications	Inspection	
3.4.3.2.c	Extended Temperature operation -40c to +85c	Environmental test	
3.4.3.2.d	outputs voltages +-5v & +-12v	Test	
3.4.3.2.e	Efficiency up to 95%	Test	
3.4.3.2.f	Output power of 10 amps at 5 volts	Test	
3.4.3.2.g	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.3.3.a	PC104 form factor	Inspection	
3.4.3.3.b	Shall be durable and provide heavy vibration resistance	Inspection	
3.4.3.3.c	Shall have a high-level of impact strength and heat resistance	Inspection	
3.4.3.3.d	Shall have easy access to cards	Demonstration	
3.4.3.3.e	Shall have easy mounting with pre-drilled and tapped holes	Inspection	
3.4.3.3.f	Shall be suitable for heat sinking	Inspection	
3.4.3.3.g	Shall support rail mounting of cards	Inspection	
3.4.3.3.h	Shall provide EMI gaskets	Inspection	
3.4.3.3.i	Shall provide EMI isolation	Demonstration	
3.4.3.3.j	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.3.4.a	Shall interface with science Computer for data transfer	Test	
3.4.3.4.b	Shall interface with TDRSS Transmitter / Receiver	Test	
3.4.3.4.c	Meet MIL-SPEC Standard & industrial Grade Environmental Specifications	Inspection	
3.4.3.4.d	Dual redundant bus for Failure backup of the Flight computers and data bus	Inspection	
3.4.3.4.e	PC/104 Form Factor	Inspection	
3.4.3.4.f	Emulation Capabilities	Demonstration	
3.4.3.4.g	Configurable to Bus controller, Bus Monitor, and remote Terminal Functionality via remote software download	Test	

3.4.3.4.h	Software (RTOS ready, Drivers written and Proven)	Inspection	
3.4.3.4.i	Input power shall be 4 watts maximum	Test	
3.4.3.4.j	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.3.5.a	PC/104 Form factor	Inspection	
3.4.3.5.b	Multiple Serial Ports per Card (need 10 to 12 total)	Inspection	
3.4.3.5.c	Input power shall be 0.4 watts maximum	Test	
3.4.3.5.d	RTOS Friendly Software drivers written and proven	Inspection	
3.4.3.5.e	Shall support interrupt sharing	Demonstration	
3.4.3.5.f	Shall contain FIFO buffer	Inspection	
3.4.3.5.g	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.3.6.a	PC/104 form factor	Inspection	
3.4.3.6.b	Shall interface to on-board hard disk drives	Test	
3.4.3.6.c	Shall provide two serial ports	Test	
3.4.3.6.d	Input power shall be 0.7 watts maximum	Test	
3.4.3.6.e	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.4.4	Flight Software Verification Matrix found in separate document	Refer to separate document	
3.5.1.1.a	Day/Night Operation	Test	
	Ground Track Accurate to 3.5 Mile Radius	Test	
	Information to steer the TDRSS antenna	Test	
	Azimuth Accurate to +/- 1.0 degrees	Test	
	Enable Time Stamp To 0.01 sec accuracy	Test	
	Enable Time Stamp To 0.1 sec update frequency	Test	
	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.5.1.2.a	Provide compatibility with ADU GPS receiver (3.5.1.1)	Test	
3.5.1.2.b	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.5.2.a	Provide ambient pressure reading within +/- 3000 feet at altitudes above 60,000 ft	Test	
3.5.2.b	Provide ambient pressure reading within +/- 1000 feet at altitudes below 60,000 ft	Test	
3.5.2.c	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.5.3.a	Sample Rate no less than 1 per minute	Test	

3.5.3.b	Accuracy of 5 %	Test	
3.5.3.c	Approximately 45 Temperatures Reported	Inspection	
3.5.3.d	Maintain functionality in ULDB environment for mission duration	Environmental test	
		Test Flight(s)	
3.5.4.a	Sample Rate no less than 1 per minute	Demonstration	
3.5.4.b	Accuracy of +/- 0.1 degree C	Test	
3.5.4.c	Placement of a minimum of 5 meters below gondola	Inspection	
3.5.4.d	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.5.5.a	Redundancy for Earth Temperature IR	Inspection	
3.5.5.b	Wavelength - 800 to 2500 nm	Inspection	
3.5.5.c	Beamwidth - 70 -80 deg for Floor and Canopy	Inspection	
3.5.5.d	6 - 60 deg for Atmospheric and Earth	Test	
3.5.5.e	Measurement accuracy of +/- one watt	Test	
3.5.5.f	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.5.6.a	Wavelength 400nm to 800nm	Inspection	
3.5.6.b	Beamwidth 70deg to 80 deg	Inspection	
3.5.6.c	One sun pointed/fixed elevation	Demonstration	
3.5.6.d	One down looking	Demonstration	
3.5.6.e	Measurement accuracy of +/- one watt	Test	
3.5.6.f	Maintain functionality in exposed ULDB flight environment for mission duration	Environmental test	
		Test Flight(s)	
3.6.a	Sun-track, in azimuth, a 3500lb. Suspended gondola with an accuracy of +/- 5 degrees.	Test	
3.6.b	Use less than 5 watts of power during steady state tracking and less then 20 watts during initial alignment.	Test	
3.6.c	Communicate to the main flight computer via RS-232 interface. System will transmit house keeping status data (i.e.. relative azimuth position) and receive up-linked commands.	Test	
3.6.d	Transmit housekeeping data to the LOS PCM stack via a second RS-232 interface.	Test	
3.6.e	Allow independent power switching of the onboard electronics and the torque motor.	Test	

3.6.f	Allow feed-through (slip-ring) of 2-22 gauge shielded twisted pair and 4-16 gauge wires	Test	
3.6.g	Operate in the flight environment.	Test	
3.6.h	Maintain structural integrity during flight termination (i.e.. 10g loading during chute deployment).	Test	
3.9.1.a	Provide chassis for mechanical integration of TIGER experiment and ULDB support systems, including Command/Data Module, PV arrays and other power components, telemetry antennas, sensors, and cryogenic components as needed	Inspection	
3.9.1.b	Provide interface from gondola to flight train and vehicle systems, including ballast hopper and impact attenuation devices	Inspection	
3.9.1.c	Provide adequate protection to systems upon ground impact	Strength Analysis	
		Test Flight(s)	
3.9.1.d	Maintain structural integrity in ULDB flight environment for mission duration	Strength Analysis	
		Load Testing	
		Test Flight(s)	